CLAIMS

1. A method of synchronizing a pulsed drive signal applied to a DC fan motor to the TACH output of the motor, the motor including a rotor that rotates in a path defined by a plurality of magnetic poles, the method comprising the steps of:

a) defining an ideal TACH output for a specific rotation speed of a rotor of the DC fan,

b) monitoring the actual TACH output of the DC fan, the TACH output indicating the passing of the magnetic poles of the fan by the rotor,

c) comparing the monitored TACH output to the ideal TACH output, and

d) changing the period of the drive signal if the monitored TACH output does not match the ideal TACH output such that the period of the drive signal matches the time taken for the fan to rotate through one magnetic pole of the fan.

2. The method according to claim 1 wherein the duty cycle of the drive signal is changed by changing the length of time, T_{OFF}, for which the drive signal is turned off.

3. The method according to claim 2 wherein the drive signal is turned off each time, for the time T_{OFF}, when the actual TACH signal indicates that the fan rotor has rotated to the start of the next pole.

4. The method according to claim 3 wherein the drive signal is turned on once the duration of T_{OFF} is complete, the drive signal being turned off again once the actual TACH signal indicates that the fan rotor has rotated to the start of another pole of the fan.

5. The method as claimed in claim 1 wherein the actual TACH signal is only monitored when the drive signal is on.

6. The method as claimed in claim 5 wherein the monitoring of the actual TACH signal provides an indication of whether the actual TACH signal is at a high level or at a low level, the actual TACH signal flipping between the high and low levels on passing of a magnetic pole.

7. The method as claimed in claim 6 wherein the monitoring of the level of the actual TACH signal provides a tracking of the rotation of the rotor of the fan.

8. The method as claimed in claim 6 wherein the level of the TACH signal is monitored after a predetermined time delay, an electromechanical (EM) delay T_{EM}, has passed since the switching of the drive signal from an off condition to an on condition.

9. The method as claimed in claim 8 wherein the EM delay T_{EM} is determined by looking at a transitiòn on the drive signal from off to on, and measuring the time it takes for the actual TACH signal to change state from high to low, if the true state is low.

10. The method as claimed in claim 5 further including the step of sampling the level of the TACH signal continuously while the drive signal is on.

11. The method as claimed in claim 7 further including the step of sampling the level of the actual TACH signal during a time T_{OFF} when the drive signal is normally off.

12. The method as claimed in claim 11 wherein the step of sampling the level of the actual TACH signal is effected by turning the drive signal on for a time period sufficient to enable a detection of the level of the TACH signal.

13. The method as claimed in claim 12 wherein the level of the actual TACH signal is sampled more than once during the T_{OFF} time.

14. The method as claimed in claim 13 wherein two sample signals are applied, a first sample signal at a time approximately equivalent to ¼ T_{OFF} and the second at a time ½ T_{OFF}.

15. The method as claimed in claim 14 wherein the duration of each sample signal is greater than a predetermined electromechanical delay T_{EM}, the electromechanical delay being determined by looking at a transition on the drive signal from off to on, and measuring the

time it takes for the actual TACH signal to change state from high to low, if the true state is low.

16. The method as claimed in claim 1 wherein the defined ideal TACH output is provided by a look up table.

17. The method as claimed in claim 16 wherein the look up table is a discrete mode look up table.

18. The method as claimed in claim 16 wherein the look up table is a linear mode look up table.

19. The method as claimed in claim 16 wherein the look up table is a ratio mode look up table.

20. The method as claimed in claim 1 wherein the defined ideal TACH output is provided by a plurality of user inputs.

21. The method as claimed in claim 20 wherein the plurality of user inputs include the number of poles of the fan and a rotation speed of the fan.

22. The method as claimed in claim 21 wherein the rotation speed of the fan is provided as a direct input by the user.

23. The method as claimed in claim 21 wherein the rotation speed of the fan is related to an operating temperature, the relationship being user defined.

24. The method as claimed in claim 23 wherein the user defined relationship is effected by defining a range of temperature values and relating this defined range to a range of rotation speeds.

25. The method as claimed in claim 2 wherein the off time of the drive signal, T_{OFF}, is adjustable, an adjustment of T_{OFF} effecting a change in the speed of the fan motor.

26. The method as claimed in claim 1 further including the step of determining the speed of the fan motor, the speed being determined by:

a) defining the number of poles of the fan,

b) determining when the rotor has passed a first pole of the plurality of poles,

c) determining when the number of poles passed by the rotor is equivalent to the defined number, and

d) calculating the time period between step b) and step c) so as to define a total time for a single rotation, thereby providing an indication of the actual speed of the fan motor.

27. The method as claimed in claim 26 further including the step of defining a desired speed for the fan motor.

28. The method as claimed in claim 27 wherein the desired speed is related to an operating temperature of the location of the fan motor.

29. The method as claimed in claim 27 wherein the off time of the fan motor, T_{OFF}, is adjustable until the desired speed substantially matches the actual speed.

30. The method as claimed in claim 29 wherein the amount by which the off time T_{OFF} of the drive signal is adjusted may be varied.

31. The method as claimed in claim 30 wherein the variance is related to the difference between the desired speed and actual speed.

32. The method as claimed in claim 29 wherein the frequency at which the off time T_{OFF} is adjusted is configurable.

33. The method as claimed in claim 32 wherein the frequency is related to the characteristics of a particular fan.

34. The method as claimed in claim 1 further including the step of monitoring the change of the actual TACH levels so as to determine whether the fan has stalled, a stall being defined by an occurrence of multiple sequentially monitored actual TACH levels being of the same level.

35. The method as claimed in claim 34 wherein on determining the occurrence of a stall, the drive signal is pulsed on and off until two sequentially monitored actual TACH levels are of a different level.

36. The method as claimed in claim 1 further including the step of forcing the drive signal to a continuous on or a continuous off condition.

37. The method as claimed in claim 11 wherein the step of sampling the level of the actual TACH signal during a time T_{OFF} when the drive signal is normally off provides an indication as to whether the actual fan speed is a multiple of the speed indicated by the monitored actual TACH level.

38. The method as claimed in claim 37 further including the step, on determining that the actual speed is a multiple of the speed indicated by the monitored actual TACH level, of correcting the actual speed to reflect the monitored actual TACH level.

39. The method as claimed in claim 38 wherein the correction step is effected by reducing the duration of the off time T_{OFF} of the drive signal.

40. The method as claimed in claim 39 wherein the off time T_{OFF} is reduced to a time period shorter than the time period for the fan rotor to pass adjacent poles, T_{POLE}.

41. A DC fan speed controller adapted to synchronize a pulsed drive signal applied to a DC fan motor to the TACH output of the motor, the motor including a rotor that rotates in a path defined by a plurality of magnetic poles, the controller having:

a) means for defining an ideal TACH output for a specific rotation speed of a rotor of the DC fan,

b) means for monitoring the actual TACH output of the DC fan, the TACH output indicating the passing of the magnetic poles of the fan by the rotor,

c) means for comparing the monitored TACH output to the ideal TACH output, and

d) means for changing the period of the drive signal if the monitored TACH output does not match the ideal TACH output.

42. The controller as claimed in claim 41 wherein the means for changing the period of the drive signal is adapted to enable a change in the period so as to ensure that the period of the drive signal matches the time taken for the fan to rotate through one magnetic pole of the fan.

43. The controller as claimed in claim 41 wherein the speed of the fan motor is defined by:

a) a first register value defining the number of poles of the fan,

b) a first sensor adapted to determine when the rotor has passed a first pole of the plurality of poles, the first sensor being adapted to effect an update of a second register so as to increment the number of poles passed by the rotor

c) a comparator adapted to determine when the number of poles passed by the rotor and stored in the second register is equivalent to the defined number, and

d) a timer adapted to calculate the time period between step b) and step c) so as to define a total time for a single rotation, thereby providing an indication of the actual speed of the fan motor.

44. The controller as claimed in claim 41 wherein the ideal TACH output is related to the operating temperature of the fan.

45. The controller as claimed in claim 41 wherein the means for monitoring the actual TACH output of the DC fan monitors the actual TACH output when the drive signal is on.